module may be displayed. Next, the user requests a position and places the selected module in a graphical user interface, which represents the resources available to implement the available modules. For example, the resources may be programmable system blocks. Additional user modules may then be selected and placed.

A2 cont

Please replace the paragraph beginning at page 4, line 21 with the following new paragraph:

The user then configures the circuit by selecting circuit parameters for the user modules (e.g., amplifier gain), pin configurations, and interconnections between programmable system blocks. The user may then edit source code used to cause the user modules to perform their functions.

Please replace the paragraph beginning at page 5, line 1 with the following new paragraph:

Another embodiment allows the user to select a new position (e.g., new programmable system block or blocks) for a selected user module. In response to such a user request, a new potential position is computed and displayed for the user module.

Please replace the paragraph beginning at page 7, line 6 with the following new paragraph:

A3

Figure 6A, Figure 6B, Figure 6C, and Figure 6D are illustrations of graphical user interfaces for configuring interconnections between programmable system blocks, according to an embodiment of the present invention.

Please replace the paragraph beginning at page 9, line 2 with the following new paragraph:

A4

Referring now to Figure 1B, a user module placement work-space includes a resource graphic window 360 illustrating the placement of user modules 304 with respect to the available resources (e.g., available programmable system blocks 410 of a microcontroller) in a hardware layout graphical display. Throughout this application the term resource image may denote the blocks 410 upon which

user modules 304 are placed in window 360. As the resource images may represent programmable system blocks in one embodiment, the resource images may be referred to as programmable system blocks for convenience. It will be understood that the resource images may represent other resources however, as the present invention is not limited to implementing the user modules 304 in programmable system blocks. Figure 1B shows a number of digital programmable system blocks 410a along the top row (e.g., the blocks labeled DBA00, DBA01, etc.), as well as four columns of analog programmable system blocks 410b (e.g., the blocks labeled ACA00, ACA01, etc.). The present invention is well suited to using any number of analog and digital programmable system blocks 410. Furthermore, the blocks in graphic window 360 are not limited to representing programmable system blocks.

a4 cont

Please replace the paragraph beginning at page 9, line 19 with the following new paragraph:

A single user module 304 may map to one or more programmable system blocks 410. Color coding (not shown) may be used to relate the user modules 304 of selected modules window 306 with their schematic placement in resource graphic window 360. The analog 410b and digital 410a programmable system blocks may be more generally defined as two different classes to which a user module 304 maps. The present invention is well-suited to having many different classes.

Please replace the paragraph beginning at page 10, line 2 with the following new paragraph:

Referring now to Figure 1C, a pin-out configuration work-space is shown. The pin-out configuration work-space allows the user to connect programmable system blocks 410 to input/output (I/O) pins, as well as configure the I/O pins' drive characteristics. In one embodiment, a pin configuration window 380 may be used to configure pins. Pin configuration window 380 has a port column 381, a select column 382, and a drive column 383. In another embodiment, a user

a4 cont

may set pin configurations by clicking on the GUI of the chip 610. The operation of these features will be discussed more fully herein.

Please replace the paragraph beginning at page 11, line 11 with the following new paragraph:

User modules 304 may require multiple programmable system blocks 410 to be implemented. In some cases, user modules 304 may require special ports or hardware which will limit the number of programmable system blocks 410 that can be used for their implementation. The process of mapping a user module 304 to programmable system blocks 410, such that the user module 304 is realized within the microcontroller, may be referred to as "user module placement." An embodiment automatically determines the possible placements of a user module 304 based on an Extensible Markup Language (XML) user module description and the hardware description of the underlying chip. However, the present invention is not limited to using XML descriptions. The potential placement positions may be automatically inferred based on the XML input data. Therefore, the placement process of embodiments of the present invention is data driven.

a5

Please replace the paragraph beginning at page 11, line 24 with the following new paragraph:

Referring to step 220 of Figure 2, a user then requests a possible placement for a user module 304 in the resource area 360. One or more programmable system blocks 410 may be highlighted to indicate a possible position for the user module 304 based on, for example, XML input data. For example, referring to Figure 1B, the ADCINC12_1 user module 304 has been selected for placement in the window 360. This user module 304 requires two digital blocks 410a and one analog block 410b. The digital programmable system blocks 410a labeled DBA00 and DBA01 are highlighted to indicate a possible position for the ADCINC12_1 user module 304. Referring now to Figure 3A, the analog programmable system block 410b labeled ASB20 is highlighted to indicate that it is a possible position for the analog portion of the ADCINC12_1 user module 304. Embodiments may

use color coding to associate the highlighting color with a unique color assigned to that user module 304.

a5 cont

Please replace the paragraph beginning at page 12, line 12 with the following new paragraph:

User module placement is described in co-pending U.S. patent application serial number 09/989,762, filed concurrently herewith, entitled "A SYSTEM AND METHOD FOR PERFORMING NEXT PLACEMENTS AND PRUNING OF DISALLOWED PLACEMENTS FOR PROGRAMMING AN INTEGRATED CIRCUIT," by Ogami et al., attorney docket number CYPR-CD01175M and assigned to the assignee of the present invention and incorporated herein by reference.

Please replace the paragraph beginning at page 12, line 19 with the following new paragraph:

Referring now to Figures 3A-3C and to step 240 of Figure 2, after placing a user module 304, a user may desire to move it to another programmable system block 410 (or blocks). In step 240, the user may request a new position for the user module 304 by, for example, clicking a next placement icon 371. In response to this, a new placement may be computed and displayed. Figures 3A-3C illustrate three possible positions for the analog portion of the ADCINC12_1 user module 304. Placements that are incompatible with the user module requirements are automatically pruned out by the software and therefore are not displayed as valid placements. In one embodiment, all positions are shown to the user, sequentially, each time the next placement icon 371 is selected. However, if a potential placement involves a programmable system block 410 that has already been used (e.g., by another placed user module 304), then in these cases the place user module icon 372 is grayed out indicating that this placement is only valid if the resources were vacant. This allows the user to see all possible placements.

Please replace the paragraph beginning at page 14, line 1 with the following new paragraph:

a6 Referring now to step 250 of Figure 2, the user may then select the new position by clicking on the select position button 372 when the user module 304 is on the desired programmable system block or blocks 410.

Please replace the paragraph beginning at page 14, line 5 with the following new paragraph:

User module next placement is described in co-pending US patent application serial number 09/989,781, filed concurrently herewith, entitled "SYSTEM AND METHOD FOR DECOUPLING AND ITERATING RESOURCES ASSOCIATED WITH A MODULE," by Ogami et al., attorney docket number CYPR-CD01180M and assigned to the assignee of the present invention and incorporated herein by reference.

Please replace the paragraph beginning at page 14, line 12 with the following new paragraph:

The user may repeat steps 210 through 250 to add more user modules 304. Each time a new user module is selected, a system resource window is updated. Referring again to Figure 1A, for each User Module 304 selected, the system updates the data in a resource manager window 350 with the number of occupied programmable system blocks 410, along with RAM and ROM usage used by the current set of "selected" User Modules 304. The system may also prevent a user from selecting a User Module 304 if it requires more resources than are currently available. Tracking the available space and memory of configurations for the design may be performed intermittently during the whole process of configuring the microcontroller. There is also a live graph tracking the programmable system blocks 410 used by percentage. The RAM and ROM monitors track the amount of RAM and ROM required to employ each selected User Module 304.

Please replace the paragraph beginning at page 15, line 1 with the following new paragraph:

After the user has selected one or more user modules 304, the user selects global parameters and user module parameters. Embodiments allow a user to select user module parameters, such as, for example, the gain of an amplifier, a clock speed, etc. Referring now to Figure 4 and to step 260 of Figure 2, in response to a user clicking on a region on a programmable system block 410 an interface 510 is displayed which allows the setting of user module parameters. For example, the user may place "the cursor" over the lower-left corner of a programmable system block 410 to set input parameters. The system may display a superficial chip or a changed cursor in response to this. The user may then left-click a mouse, for example, to bring up a user module parameter window 510 to configure the user module input parameters. The process may be repeated in the lower-right corner of the programmable system block 410 for output parameters and on the upper-left corner for clock parameters. The present invention is not limited to these steps for bringing up a user module pop-up window 510, however. The system may then display the selected parameters in a user module parameter window 520. Various pop-up windows may be data driven in that the contents of the pop-up window may depend on, for example, the user module 304 selected. Alternatively, user parameters may be set in the user module parameter window 520.

Please replace the paragraph beginning at page 15, line 20 with the following new paragraph:

When the user module 304 is placed (e.g., instantiated) on a particular programmable system block 410 the register settings and parameter settings are mapped to a physical register address on the chip. This also associates interrupt vectors that the user module 304 uses based on the programmable system block 410. Each of the digital blocks 410a maps to one vector and each column of analog blocks 410b maps to another vector. Once the user modules 304 are placed and the parameters are set, all the physical address registers that are associated with that user module 304 are fixed and the register values are determined.

Please replace the paragraph beginning at page 16, line 12 with the following new paragraph:

Referring now to Figures 5A-5C and to step 270 of Figure 2, the user selects input/output pin configurations. One embodiment provides for a graphical user interface for facilitating the configuration of I/O pins in a microcontroller software design tool. By specifying a programmable system block 410 to a pin-out, a user may make a physical connection between the software configuration and the hardware (e.g., the microcontroller). Each pin has a pin number associated therewith. Referring to Figure 5A, when the user clicks on a pin of GUI 610, a small window 375 opens allowing the pin type (e.g., Port_0_1) and drive type (e.g., Port_0_1_Drive) to be configured. Referring now to window 620 of Figure 5B, the pin type may include analog input or analog output or global bus, etc. Referring now to window 630 of Figure 5C, the drive type may include high-z, pull-up, pull-down, strong, etc. The windows 620 and 630 may include a list that contains items that can be selected using the cursor. When the cursor is clicked outside of the windows 620 or 630, then the windows 620, 630 disappear automatically.

Please replace the paragraph beginning at page 17, line 17 with the following new paragraph:

Pin configuration is described in co-pending U.S. patent application serial number 10/032,986, filed October 29, 2001, entitled "PIN-OUT CONNECTIONS/DRIVE LEVELS DIRECT-SET BY DROP DOWN LIST," by Ogami et al., attorney docket number CYPR-CD01173M and assigned to the assignee of the present invention and incorporated herein by reference.

Please replace the paragraph beginning at page 17, line 23 with the following new paragraph:

Referring now to Figure 6A-6D and to step 280 of Figure 2, the user selects programmable system block 410 interconnectivity. Embodiments provide many different windows to assist the user in setting various parameters to specify interconnectivity of programmable system blocks 410.